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Richard S Roberts
P.O. BOX 484
Princeton, NJ 08542-0484

EXAMINER

SARKAR, ASOK K

ART UNIT

PAPER NUMBER

2829

DATE MAILED: 04/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/841,453

Applicant(s)

WU ET AL.

Examiner

Asok K. Sarkar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-34 is/are pending in the application.
- 4a) Of the above claim(s) 30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-29 and 31-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 2 – 16, 18 – 21 and 31 – 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin, EP 0849,796 in view of Grainger, US 5,686,549 and Kotelnikov, RU 2089499.

Regarding claim 20, Jin teaches nanoporous silica xerogel film produced by hydrolysis/condensation of organosilane compounds (see column 4, lines 23 –28) on a substrate (see Figs. 3 and 7b) whereby the silica film is reacted with a surface modification agent to modify the pore surfaces with HMDS to form a hydrophobic coating on the silica film by reacting silanol groups of the silica film with HMDS in column 4, lines 47 - 52. Reacting under conditions for a sufficient period of time to form the hydrophobic coating is inherent in Jin's method.

Jin fails to expressly teach surface modification agent to comprise one type of oligomer or polymer.

Grainger teaches a method of imparting hydrophobicity (see column 4, line 59) to surfaces containing oxygen and hydroxyl groups such as silica gel (see column 12, lines 51 – 58) with types of oligomer and polymer reactive with the silanol groups (see column 5, lines 47 – 40 and column 7, lines 52 – 57) when the silica films are used as a

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dielectric for microelectronics and formed on a substrate (see detail description of the hydrophobization process in column 14, lines 34 – 67, especially in between lines 39 – 42).

Kotelnikov teaches hydrophobization of silica surfaces with siloxane monomer (see the Abstract of their disclosure).

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Jin's hydrophobizing process by replacing the HMDS with an oligomer or polymer as taught by Grainger and Kotelnikov since Jin's hydrophobization process of the porous silica film (gel) is performed by the same type of organosilane compounds. Moreover, replacing Jin's monomer with Grainger's and Kotelnikov's oligomer and/or polymer will provide a silica gel with improved hydrophobicity and other improved properties as taught by Grainger and Kotelnikov.

Regarding claim 2, Grainger teaches the presence of solvent during reaction in column 12, lines 10 – 12.

Regarding claims 3 and 4, Jin and Burns teaches the dielectric film of dielectric constant of 1.3 - 3 (see Jin, column 1, line 27) silica gel which inherently contains pores and silanol groups (Jin, column 4, line 43) and Grainger teaches the reaction conditions where the reaction is conducted for sufficient amount of time in column 12, lines 22 – 32.

Regarding claims 5 and 6, Grainger teaches temperature range of 20 – 250°C (room temperature – molten temperature) in column 12, lines 22 – 32 and Jin teaches

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rinsing with the silazane compound (short reaction time) in column 4, lines 48 – 50 and Kotelnikov teaches reaction time of about an hour in second paragraph of page 6.

Regarding claim 7, Jin teaches surface modification agent of a silazane compound capable of reacting with the silanols in column 4, lines 47 - 52. The oligomer and the polymer of the same type of monomers have the same functional groups and are capable of reacting with the silanols (see Grainger, column 5, lines 47 – 49 and column 7, lines 52 – 57).

Regarding claims 8, 11, 14, 18 and 19, Grainger teaches polymeric siloxanyls in column 5, line 49 and organosiloxanes in column 7, line 53, which are formed by reacting a suitable monomers (e.g. methylsiloxane) in a solvent and are also disclosed in the polymer synthesis process of various examples in columns 7 – 11.

Regarding claims 9 and 10, Grainger teaches hydrocarbon as solvent in column 12, lines 18 - 19.

Regarding claims 12 and 13, Grainger teaches the presence of organic solvent for the reaction in their reaction process but fails to expressly teach water and the water to organic cosolvent ratio.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to use a water miscible starting monomer since low molecular weight siloxane and silane monomers are water soluble and therefore a mixture of water miscible monomer and organic solvent can be used for the hydrophobization treatment and judiciously adjust and control these parameters during the

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hydrophobization process of silica gel film through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05).

Regarding claim 15 and 16, Jin teaches surface treatment with a monomeric surface modifying agent and Grainger teaches, in addition, surface treatment with a polymeric surface modifying agent that reacts with the silanol groups of the silica gel and it would have been obvious to one with ordinary skill in the art at the time of the invention to apply Jin's process and then modify the process by applying Grainger's process.

Regarding claim 21, Jin teaches strong nanoporous silica film (dielectric constant of 1.3 – 3 in column 1, line 27) suitable for drying and polishing in columns 4 and 5, but fails to expressly teach the break strength of 2000 PSI.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Jin's process by applying Burns' process and produce a silica gel structure of break strength above 2000 PSI by controlling the porosity of the gel by proper drying process since strength of a material is controlled by the amount and the size of the pores.

Regarding claim 31, Jin fails to teach a polymeric siloxane compound.

Grainger teaches polymeric siloxane compounds having a formula $(-\text{SiXR}-\text{O}-)_n$ in column 6, lines 14 – 18, where $X = \text{H}$ and $R = \text{methyl}$ and $n > 2$.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Jin's process by applying a polymeric surface modifying agent of formula $(-\text{SiXR}-\text{O}-)_n$ in stead of the monomer since polymeric treatment will

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provide a silica gel with improved hydrophobicity and other improved properties as taught by Grainger.

Regarding claim 32, Jin fails to teach a polymeric methylsilane compounds.

Kotelnikov teaches polymeric methylsilane compounds for surface modification (see the abstract of the article).

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Jin's process by applying a polymeric surface modifying agent of polymeric methylsilane compounds in stead of the monomer since polymeric treatment will provide a silica gel with improved hydrophobicity and other improved properties as taught by Kotelnikov.

Regarding claims 33 and 34, Jin in view of Grainger and Kotelnikov fails to teach surface modification agents containing methyltriacetoxysilane or hydrolysis/condensation product of methyltriacetoxysilane or polyacetoxysilane.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Jin's process by applying a polymeric surface modifying agents containing methyltriacetoxysilane or hydrolysis/condensation product of methyltriacetoxysilane or polyacetoxysilane compounds in stead of the monomer these compounds are a form of oxy- silane compounds and since polymeric treatment will provide a silica gel with improved hydrophobicity and other improved properties as taught by Grainger.

3. Claims 22 – 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jin, EP 0849,796 in view of Grainger, US 5,686,549 and Kotelnikov, RU 2089499.

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These claims are rejected by applying the same prior art and arguments as were provided above in rejecting claims 2 – 21 since they are not patentably distinct from claims 2 – 21 and is also taught by Jin in column 1, line 6.

4. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jin, EP 0849,796 in view of Grainger, US 5,686,549 and Kotelnikov, RU 208 as applied to claim 8 above, and further in view of Burns, US 5,750,6.

Jin in view of Grainger and Kotelnikov fails to teach adding additional monomer in the solution.

Burns teaches surface modifying agents of monomer as well as high molecular weight siloxanes which cleaves to low molecular weight in column 6, lines 30 – 35 and mixtures of two or more are taught by Burns in column 6, lines 36 – 39.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Jin's method by using a combination of a monomer and a polymer as taught by of Grainger and Kotelnikov in view of Burns so that the hydrophobization process is improved.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

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Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 2 – 29 and 31 – 34 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 - 19 of U.S. Patent No. 6,318,124 in view of Grainger, US 5,686,549 and Kotelnikov, RU 2089499.

US 6,318,124 teaches dielectric nanoporous silica film on a substrate by forming a coating with an oligomer or polymer of organo siloxanes, but fails to teach that the coating is capable of reacting with the silanol groups as a surface modification agent and render it hydrophobic.

Grainger and Kotelnikov teach that such organosiloxanes are capable of reacting with the silanol groups of a porous silica gel and hydrophobize the surface as described earlier in rejecting claims 2 – 29. The hydrophobization process occurs by the reaction of the organic agents with the silanol groups present in the silica gel.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to use Rutherford's process and at the same time automatically hydrophobize the silica surface since the silanol group on the silica film will react with the polysiloxanes to render hydrophobic character to the dielectric film as taught by Grainger and Kotelnikov.

Response to Arguments

7. Applicant's arguments filed March 25, 2003 have been fully considered but they are not persuasive.

Applicant argues (page 9, last paragraph through page 11, 3rd paragraph) that

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Grainger and Kotelnikov fail to teach nanoporous silica film and cannot be applied to modify Jin since they teach non-analogous art. The instant invention claims making (nonoporous) silica (film on a substrate) hydrophobic by reacting the active (silanol) groups with silicon-containing oligomer or polymer surface modifying agents.

Jin teaches forming silica xerogel film produced by hydrolysis/condensation of organosilane compounds (see column 4, lines 23 –28) on a substrate.

In response, the Examiner wants to remind the Applicant that silica gels are inherently nanoporous. Additionally, the Examiner wants to remind the Applicant of two key things:

- First, the hydrophobization process is a chemical reaction between two chemicals, one is the chemical compound “silica” and the other is the silicon-containing oligomer or polymer surface modifying agent.
- Second, in order for the reaction between the silica and the silicon-containing oligomer or polymer surface modifying agent to occur quickly, the silica surface has to be prepared and/or modified to form hydroxyl groups (silanol).

Applicant agrees that both Grainger and Kotelnikov teach the silicon-containing oligomer or polymer surface modifying agents as claimed by the invention. However, he fails to agree that the other chemical compound Grainger and Kotelnikov are using to react the silicon-containing oligomer or polymer surface modifying agents with is not nanoporous (silica) film on a substrate. Applicant's emphasis on the pore surface of the film in 2nd paragraph of page 10 is not a claim limitation.

8. Examiner emphasizes the fact that the chemical reaction occurs between

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two chemical agents/compounds and the physical form of the reactant is immaterial. In other words, nanoporous silica is chemically still "silica" and will react with the silicon-containing oligomer or polymer surface modifying agents. Gels are inherently activated and will require no activation.

9. Now let's see what Grainger and Kotelnikov are teaching. Grainger teaches that silica surfaces on which hydroxyl groups has been attached can be hydrophobized by the use of these polymers in column 12, lines 51 – 57. Applicant is directed to the word silica gel in column 12, line 57. Silica gel is nothing but nanoporous silica.

10. Similarly, Kotelnikov teaches hydrophobization of activated silica surface with silicon-containing oligomer or polymer surface modifying agents (see Applicant's argument in 3rd paragraph of page 10). Again, the activation to provide hydroxyl (silanol) groups to the silica surface is imparted with alkali carbonates, which are highly alkaline (high pH) and will react with silica (acidic) surface to attach silanol groups on the silica surface. Therefore, a person with ordinary skill in the art will be motivated to modify Jin's teachings with those of Grainger and Kotelnikov since hydrophobization of porous activated silica surface with polymeric surface modifying agents is well-known prior art.

11. Applicant's continuing arguments in subsequent pages 11 through 2nd paragraph of page 13 is moot in view of the previous arguments with respect to Grainger and Kotelnikov. Since the reaction between the silica and the polymer is between the silanol and the organic functional group of the polymeric organo surface modifying agents, the same reaction suggested by Burnswith respect to monomeric organo surface modifying

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agents will also be inherently applicable in the case of the polymeric organo surface modifying agents. The function group is preserved in the polymer.

12. Regarding the double patenting rejection (page 13, 3rd paragraph), the Applicant's argument is moot in view of the previous explanations with respect to Grainger and Kotelnikov. It would have been obvious to one with ordinary skill in the art at the time of the invention to modify Rutherford's claims 1 – 19 with the teachings of Grainger and Kotelnikov and arrive at the instant invention.

Conclusion

13. This application contains claim 30 drawn to an invention nonelected with traverse in Paper No. 8. A complete reply to the final rejection must include cancelation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 703 308 2521. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kammie Cuneo can be reached on 703 308 1233. The fax phone numbers for the organization where this application or proceeding is assigned are 703 308 7722 for regular communications and 703 308 7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 4918.

Asok K. Sarkar
April 16, 2003



KAMAND CUNEO
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800